

# Compounding medications in a rural setting: an interprofessional perspective

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**Background:** Interprofessional learning (IPL) which focuses on the pharmacist's role in specialty practices as part of a multidisciplinary health care team has not been explored. This study aimed to determine health care students' understanding of the role of the pharmacist in compounding medications to optimize health outcomes for patients in rural and remote health care services.

**Methods:** Four workshops followed by focus group interviews were conducted with undergraduate pharmacy, medical, nursing, physiotherapy, dentistry, Aboriginal public health, and speech pathology students (n=15). After an introductory lecture, students working in multidisciplinary teams undertook to compound three products. Focus groups were held at the end of the compounding workshops to explore students' understanding and perceptions of these compounding activities. Thematic analysis was undertaken on the qualitative data obtained from the focus groups.

**Results:** Student participants responded positively both to the opportunity to undertake a compounding exercise and being part of an interprofessional team, perceiving benefit for their future rural and remote health practice. Four major themes emerged from the qualitative analysis: improved knowledge and understanding; application to practice; interprofessional collaboration; and rural, remote, and Indigenous context. Students acknowledged that the workshops improved their understanding of the role of the pharmacist in compounding and how they, as part of a multidisciplinary team, could deliver better health outcomes for patients with special needs, especially in a rural and remote context.

**Conclusion:** This study highlights that workshops of this nature have a role to play in developing collaborative interprofessional practice and increasing awareness of pharmaceutical services among undergraduate health students. However, further evidence is needed to assess whether positive perceptions of specialty practice IPL workshops will translate into improved patient outcomes in practice.

**Keywords:** pharmacist, extemporaneous dispensing, multidisciplinary, undergraduate students, patient outcomes

## Introduction

Compounding, the art and science of creating personalized medicines, is important in the provision of care for patients with special needs in terms of the delivery of medications which might not be available commercially for infants, children, and the elderly.<sup>1,2</sup> Many commercially available medications are not manufactured in suitable dosage forms for these special populations, e.g., liquid formulations for children and those who may be unable to swallow tablets.<sup>1,3</sup> Additionally, when drug shortages occur

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or for the treatment of rare diseases, compounded products have a place in practice.<sup>4-6</sup> Examples of altered drug products include topical ointments, eye drops, solid or liquid oral dosage forms, and intravenous infusions.<sup>3</sup> Compounding also has a place in veterinary practice, where medicines may be altered to suit drug absorption, metabolism, and swallowing abilities of different species.<sup>7</sup>

Simple compounding, involving the use of an established formulae, is a required competency for all pharmacists in Australia as part of their undergraduate degree.<sup>3</sup> Complex compounding on the other hand, which calls for specialized facilities and equipment and may contain restricted drugs, requires further postgraduate training.<sup>3</sup> The use of small-scale compounded medications carries certain risks, as they are not assessed for product quality, stability, or efficacy.<sup>2,3</sup> Ingredients may degrade when exposed to water, oxygen, or heat and may interact with excipients or preservatives used in the manufacturing process.<sup>2,3</sup> Patients may be at risk of compounding errors, such as the incorrect strength of an active pharmaceutical ingredient.<sup>8</sup> There is also a risk of contamination by micro-organisms, which has resulted in cases of infection such as meningitis that can cause permanent injury or even death.<sup>3,9,10</sup>

In the past, pharmacists and doctors have worked together to create individual therapy plans and medication for patients. With the commercialization of the pharmacy industry, the role of the pharmacist has largely changed from compounding individual medications for each patient to dispensing standardized products.<sup>9,11</sup> However, the presence of pharmacists within the collaborative health care team has been shown to improve patient outcomes and provide better health management through patient education and monitoring.<sup>13</sup>

The importance of a collaborative, team-based approach to patient care and safety has been well established within the health field. Recognition and understanding of the roles of other professions encourages practitioners within the health care team to provide better, more holistic care to patients.<sup>14,15</sup> Interprofessional learning (IPL) at a pre-registration level has been demonstrated to improve understanding and respect of other health disciplines and the importance of teamwork and communication to ensure patient safety.<sup>14,16</sup> Rural and remote communities are an ideal context for undergraduate students and health professionals to participate in IPL, generally being home to small multidisciplinary teams which provide a wide range of health services to deliver the highest possible standard of care.<sup>17,18</sup> These teams often include both resident and visiting health professionals and may rely on communications technology.<sup>17</sup>

The requirement for alternative medications and dosage forms may be determined by the patient's general practitioner who prescribes the medication<sup>20</sup> or other allied health professionals: a speech pathologist who identifies a swallowing difficulty,<sup>21,22</sup> a physiotherapist applying ultrasound, which may interfere with transdermal drug delivery,<sup>23,24</sup> or an occupational therapist identifying that a patient is unable to physically manipulate their current medication or its packaging.<sup>25</sup> This highlights the importance for other members of the health care teams to have knowledge and understanding of compounded medications.

While the importance of compounding is well established<sup>1,2,7,8,10,12</sup> and past studies have demonstrated the benefits of IPL,<sup>14,17-19,26-28</sup> there is no evidence of such interprofessional compounding workshops having taken place. This study is novel in that it undertakes to investigate students' understanding of the importance of multidisciplinary teams in regards to compounding in a rural and remote setting. It additionally aims to increase knowledge and understanding of the role of the pharmacist by other health disciplines. The findings might also be used in the future to inform curriculum content of these other health disciplines.

## Methods

### Study setting

The Mount Isa Centre for Rural and Remote Health (MICRRH) is a University Department of Rural Health (UDRH) that facilitates clinical placements for students from all health disciplines, e.g., medicine, pharmacy, dentistry, speech pathology, etc. While students undertake placements in Mount Isa, they participate in a variety of education and training sessions at MICRRH, and there was an opportunity to conduct the Compounding Medications Workshop.

A clinical pharmaceuticals specialist and academic pharmacist facilitated the lecture and workshops. An onsite compounding laboratory was set up in the clinical education simulation unit at MICRRH. Equipment and materials were supplied by the Pharmacy Department of the College of Medicine and Dentistry, James Cook University.

### Participant recruitment and data collection

Participant recruitment for this study was aimed at health care students from a number of disciplines undertaking rural placement at MICRRH. Initially, it was hoped to include at least one student from each discipline in the study; however, as participation was voluntary and only available to students on placement choosing to take part in the Compounding

Medications Workshop, not all possible health disciplines were included. The workshop was available to all students regardless of participation in the study to ensure the educational opportunity was available for all. All students who participated in the workshop consented to also participate in the study. Each group of students that participated included at least one pharmacy student in addition to students from other disciplines (the mix of disciplines varied with each session).

At the commencement of each of the Compounding Medications Workshop, all participants were informed about the study, provided an information sheet, and invited to sign an informed consent form to participate. During the workshop, students were paired with a student from a different discipline from their own. The workshop involved a compulsory 1-hour introductory lecture on the theory supporting compounding medications (including a patient case) and a 2-hour workshop compounding three pharmaceutical products. The workshop lead students through the stages of preparing the three compounded products, which included a transdermal cream, a topical cream, and a medicated lip balm. These products were chosen as appropriate for the skill level of the participants and for the resources and equipment available in this setting.<sup>26</sup> At the conclusion of the workshop all participants engaged in a focus group, which explored views on the multidisciplinary compounding workshop, especially in a rural and remote context, including discussion regarding the similarities and differences between urban and rural practice. All focus groups were audio recorded with explicit consent. Each focus group lasted ~30 minutes. In addition to the focus group questions, participants were also asked to provide feedback about the workshop as a quality improvement activity.

## Data analysis

Focus group transcripts were thematically analyzed manually and audio recordings were transcribed verbatim. The participants' narratives were read and re-read while listening to the audio recordings to familiarize the researcher with the content and to confirm the accuracy of the transcriptions. Common content of the transcripts were coded and grouped into themes, which were allocated titles and further reviewed for coherence. Principles of credibility and confirmability were confirmed to ensure the rigor of the analysis.<sup>15</sup> Credibility was established by all three authors examining the data independently and eliciting themes. One of the authors regularly facilitates compounding workshops for undergraduate students and is well placed to lead focus group discussion around participant's perspectives and offset researcher

bias. The "Results" section describes direct quotes from participants to demonstrate confirmability. Reflexivity was employed to ensure that participants' narratives were not changed by the researchers' assumptions and were correctly represented in the research findings. The inclusion of three researchers in the process of translation and data analysis achieved analysis triangulation. Additionally, the comparison of the focus group findings with the students' feedback and evaluation of workshop afforded data triangulation.

## Ethical considerations

James Cook University Human Research Ethics Committee granted ethical approval (H7057). All participants signed a written informed consent form to participate in the focus group, which stated that they were free to leave the study at any time. To ensure confidentiality, all interview transcripts were de-identified, with any potentially identifying words removed.

## Results

### Participants' profile

Fifteen undergraduate health students (second year+) on rural clinical placements participated in the study. The median age of study participants was 23 years (interquartile range 22–28 years). Seven health professions were represented by the student sample, i.e., medicine (2), pharmacy (5), dentistry (2), speech pathology (2), physiotherapy (2), nursing (1), and Aboriginal public health (1). Of the 15 participants, 12 were female and three were male. All except one student had previously undertaken a rural or remote placement and all except three students originated from a nonmetropolitan city.

Four focus group sessions were conducted to explore students' experience of the interprofessional compounding medications workshop within a rural and remote context (Box 1). Analysis of the focus group data indicated that students perceived the workshop to be a useful activity that improved their understanding of compounding medications, the role of pharmacists, and the contribution of different disciplines.

Four themes emerged from the data: knowledge and understanding; application to practice; interprofessional collaboration; and rural, remote, and Indigenous context.

### Knowledge and understanding

All students agreed that the workshop improved their knowledge and understanding of the concept of compounded medications. Students from disciplines other than pharmacy described the concept of compounding as new and interesting. There was wide acceptance that they would benefit

**Box 1** Focus group questions and prompts to explore health care students' experience of an interprofessional compounding workshop in a rural setting

**Focus group questions**

1. What new knowledge about compounding practice have you learned?
  - a. Prompts: raise each of the disciplines involved individually.
2. What have you learned about your own discipline or other disciplines in the management of a patient with unique pharmaceutical product needs in a rural and remote context?
  - a. Prompts: importance of a multidisciplinary approach, patient considerations.
3. What are the enablers and barriers to compounding in your practice/placement?
  - a. Prompts: location, availability, cost.
4. How will what you have learned impact on your practice/placement in a rural setting?
  - a. Prompts: what changes to practice will you make.

from more education about compounding medications at an undergraduate level. Pharmacy students explained that their prior knowledge was validated and extended with respect to both the nature of the medications prepared and the “practice” setting in the workshop. Their comments included:

“I learned so many different things, and different ways they can be used. Things can be compounded. I’ve only ever seen the creams made, I didn’t realize transdermal products were compounded.”

“You’ve got to be resourceful with what you’ve got. And that’s why I think understanding the role of each excipient is important.”

“Because I have had no exposure to compounding medicine so it’s really new for me. So it’s just being aware of these things that’s out there. In future, if I have a patient and something like this comes up, I know that there are other options available and I wish we had something like this at our med school.”

Participants described the information learned as useful for their own practice and that there is potential to share their new knowledge with patients. Terms including customized medicines, individualized medicines, personalized medicines, available options, and alternatives were elicited from the focus groups. These terms reinforced a patient-centered care approach to health.

“Yeah, and I think that information about how it relates to dentistry was really beneficial. Extra knowledge that we as professionals can have and pass on to patients.”

There was broad consensus that the workshop promoted a greater understanding among other disciplines of the role of pharmacists and that the workshop provided an opportunity to better recognize the different, more specialized roles of the pharmacist.

“It’s good to get that different side and understand what pharmacists do.”

## Application to practice

Students acknowledged a relationship between their practice and compounding medications. Some students described a connection through their ability to explain alternative options to patients and others made direct links to their own practice.

“I think in terms of application of knowledge, knowing things like you’re talking about with the patches, and creams that are commonly used in a physio practice in massage.”

“If a Nurofen gel is being systemically absorbed and they’re popping NSAIDs as well, you’ve got to start thinking about that, maybe we should withdraw one of those.”

“In dentistry, you do come across illnesses, which are topical and things like membranous candidiasis, primary herpes, viruses, gingivostomatitis, and those things, compounding could be better for those things. There are commercially available things, but sometimes you wanna use something else, or you wanna add something into it and there’s the option to do that.”

“I think that could be integrated better and we could be made aware of the fact that this is an option because as everyone said especially in rural and remote areas which our degree focuses on, I think that there’s a lot of misconceptions about medications, so if you can deliver it in a different way or a way that’s effective for that person, that’s better for them than a generalized approach.”

There was recognition from participants that although they may not ever use compounding directly, they appreciated having the knowledge and hands-on exposure of the specialty for their own practice and the opportunity to share with patients who may benefit.

“Always good to tell my clients, and also to explain what a pharmacist does.”

“I’m more able to understand things practically, and it’s probably why I’m a physio. And then it means I’m probably

better able to explain it to someone if it came up, because I have that hands-on grasp and you don't really forget that."

Furthermore, students realized the potential for compounded medications to provide more suitable alternatives for patients with a variety of health conditions they have experienced in their practice, including scabies, mites, head lice, worms, stroke, diabetes, and for those patients who might be non-adherent or where medications are ineffective and for those patients with dysphagia.

"In med, prescribing different drugs, it's nice to know that you don't have to prescribe an already made thing, you can individualize a medication for a patient. Like if someone doesn't like swallowing pills, you can give them other things."

"Knowing that there's alternative dosage forms that can be given to patients if they can't take their medication, say, orally."

## Interprofessional collaboration

Participants were emphatic about the value of an interprofessional workshop. They described shared knowledge across disciplines and the importance of interprofessional collaboration for better patient outcomes.

"As a physio, if I have someone talking to me about medications that may or may not be working well for them, it's probably involving the pharmacist or liaising a bit more and seeing if they can come up with ways to make something more appropriate."

"I think any health discipline can learn from it. Because it should be more part of our practice, and we talk about patient-centered care, and an individual will benefit from a cream rather than a tablet, or something like that."

Pharmacy students appreciated the opportunity to share with other disciplines more about the role of pharmacists generally as well as the more specialized pharmacy services such as compounding pharmaceuticals.

"I think it's really good for people in other disciplines to understand, the different, less prominent aspects of our role in a pharmacy."

"I guess it's quite good for other health professionals to understand that there are other aspects to the role."

"I really enjoyed having a physio (in group), I enjoyed having a different discipline in with us because they're not really exposed to that, and by teaching someone who hasn't been exposed to that it really solidifies your own knowledge.

It's a lot easier to do something, it's harder to explain to someone else, to teach them how to do it."

The workshop also afforded opportunity for all disciplines to consider interprofessional practice in their own disciplines and how each health care professional can learn from others.

"We don't know a huge amount about medications, and whether they be oral or topical, however it comes, so for us, from a swallowing perspective, it would be good to know what the alternatives are. And also oral hygiene. Especially people who have dysphagia, elderly people. There's definitely a place in speech pathology for learning more about this."

"I think it's really ironic that we're in the mouth, but I never think of swallowing."

"I just never really think that dentists would have to prescribe medications or, obviously you're looking in the mouth and there's infections and diseases, but I just never really thought that that would be something that you would recommend or you would prescribe, so I guess it's good to have that extra knowledge."

Students described the workshop as being useful for a range of health professionals, including nurses, physiotherapists, medical practitioners, speech pathologists, and occupational therapists. One participant proposed that "any health discipline can learn from it," and all in the focus group concurred with this statement.

## Rural, remote, and Indigenous context

Participants described a variety of enablers and barriers to the application of compounding medications in a rural setting. They acknowledged that cost, adequately trained staff, functioning equipment, and access to materials may limit the capacity of a pharmacy to provide a compounding service. In their rural placement experience, pharmacy students described only limited compounding practices.

"There's more need to be resourceful out here with what you've got, because sometimes you'll have different patient needs and it's a lot harder, you can't just refer someone onto the next pharmacy if you can't provide the service because there's only three pharmacies in town."

Participants also described a potential application of compounding medications to Indigenous health care. One participant was inspired by the potential of compounding traditional Indigenous bush medicines and Western medications for a more culturally appropriate method of managing health conditions in rural settings.

“With Aboriginal health, some people don’t have electricity, they don’t have a fridge, they don’t have all these other things so we’ve gotta think of alternative ways to deliver that so people can be well.”

“Some people, certain types of medications may not be receptive to them for cultural purposes, so we might need to change things so that we can actually do best practice and still be culturally sensitive.”

“I guess there’s two sides, because you might be able to make a product that someone’s more likely to use, or something that could be more culturally acceptable, but then there’s the huge cost, and a lot of Indigenous people here wouldn’t be able to afford those options.”

## Discussion

The findings of this study have demonstrated that students from multiple health disciplines valued the learning opportunity and the hands-on aspect of the compounding workshop. They confirmed an improved knowledge and understanding of this specialized activity and recognized the application to practice, particularly in a rural and remote setting. Students valued the interprofessional design of the workshop and enjoyed a collaborative approach to individualizing medicines.

The compounding workshop has provided opportunity for undergraduate students from multiple disciplines to gain an improved understanding and appreciation of the role of the pharmacist. In particular, students concurred that they had gained new knowledge of both the general role of pharmacists and specialized practice areas such as compounding pharmaceuticals. Students described the value of this workshop in relation to their future practice.<sup>29</sup> They felt that knowledge gained from the workshop has broadened their understanding of patient considerations relating to medication administration<sup>24,30</sup> and given them confidence in identifying and referring patients who may benefit from a compounded product.

Students also recognized their individual disciplines’ contribution to medication management for patients.<sup>28</sup> Dental students who work predominately in the mouth described a lack of consideration for swallowing difficulties. Similarly, speech pathology students who frequently conduct swallowing assessments had not previously considered the role of the pharmacist in developing dosage forms that are appropriate for patients with various swallowing impairments, such as dysphagia.<sup>20,22</sup> Physiotherapy students made connections between their work with topical preparations and the concept of medication delivery through the skin.<sup>23,24</sup>

Providing this workshop in a rural and remote setting encourages students to consider enablers and barriers to medication management in an isolated environment.<sup>31–33</sup> It allowed pharmacy students to consider the specialized training,<sup>6,8</sup> equipment,<sup>6,7,11</sup> time,<sup>7,11</sup> and costs<sup>23</sup> associated with compounded pharmaceuticals and the pathways for obtaining compounded products in areas where compounding is impractical. Indigenous health connections were made particularly in regard to the potential for compounded bush medicines and alternative delivery methods to aid adherence for this vulnerable population.<sup>33</sup>

Literature has described the importance of interprofessional, collaborative, and patient-centered care and its particular importance in rural and remote areas.<sup>13,17,18,27–29</sup> Effective rural health care delivery is increasingly viewed as a team approach, rather than a series of individual health professionals’ efforts.<sup>17</sup> Conducting this workshop in a rural community allowed participants to reflect on actual rural health care practice. It also provided students with a better understanding of holistic rural health service delivery to develop skills in gathering information about services and resources available.

This study is unique in that it involved students on rural and remote placements and thus aims to develop students’ understanding of multidisciplinary practice in rural practice, which is essential to isolated practice; however, it does have some limitations. This study was a single-center study conducted without a control group. Therefore, assessing the value of the workshop is not straightforward. Additionally, the results are limited to student opinions and perceptions and do not demonstrate whether the knowledge gained will be applied to future practice. The majority of evidence relating to compounding includes only pharmacy students at metropolitan universities.<sup>34</sup> This study, however, includes students from pharmacy, medicine, dentistry, and allied health disciplines from both metropolitan and regional universities and thus gives credibility to our findings.

## Conclusion

This study adds to evidence that health care students believe that IPL activities have potential to positively impact on their future practice. It also provides evidence that workshops of this nature increase knowledge, awareness, and appreciation of the role of health care professionals, in this case the pharmacist, as an important part of a multidisciplinary health care team. Based on the results of this study, these workshops are an effective method for facilitating interprofessional

collaborative practice. Future research should explore further the benefits of engaging students in specialty practices in both rural and urban settings to determine whether the experience, knowledge, and understanding gained will impact on future practice.

## Acknowledgments

We would like to acknowledge the undergraduate students in health who generously gave their time to participate in this study. We would like to thank the Pharmacy department in the College of Medicine and Dentistry, James Cook University for providing the equipment and consumables used for the workshop, and Mount Isa Centre for Rural and Remote Health for facilities, funding, and their support for this initiative. We would also like to thank the following people who have supported this study: Julie Emmerson, Pharmacy James Cook University for Technical Assistance, and Gail Whebell, Student Placement Coordinator, MICRRH.

## Disclosure

The authors report no conflicts of interest in this work.

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